

Chapter 6.10

Light steel framed walls and floors



6.10 Light steel framed walls and floors

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SCOPE

This Chapter gives guidance on meeting the Technical Requirements and recommendations for light steel framed walls and floors.

DESIGN STANDARDS

6.10 - D1 Design shall meet the Technical Requirements

Design that follows the guidance below will be acceptable for external and internal walls, and floors using light steel framing.

This Chapter only applies to light steel framing, typically 0.45 to 3.2mm thick, as described and illustrated. Construction should be 'warm frame' with sufficient insulation outside the steel envelope to ensure that condensation does not fall within the depth of the light steel members.

For dwellings that incorporate loadbearing light steel framed walls and/or floors, both system and project certification will be required in accordance with Appendix 6.10-A.

For the purpose of this Chapter, non-loadbearing walls are those not designed to carry the principal dead and imposed loads or provide the overall stability for the building. In some circumstances (e.g. external infill walls) they will carry wind loads.

If the light steel framing is of a novel construction, not shown in this Chapter, NHBC will require assessment in accordance with Technical Requirement R3.

This Chapter does not apply to light steel framed external walls used in basements.

STATUTORY REQUIREMENTS

6.10 - D2 Design shall comply with all relevant statutory requirements

Design should be in accordance with relevant Building Regulations and other statutory requirements.

STEEL AND FIXINGS

6.10 - D3 Steel and fixings shall be suitable for the design and adequately protected against corrosion

Items to be taken into account include:

(a) steel

Steel should be grade S280 or S350 to BS EN 10326. Grade S390 steel may be used if it has a nominal yield strength of 390N/mm² and meets with the concepts of BS EN 10326.

To provide adequate protection against corrosion due to condensation and the environment, steel should be pre-galvanised in accordance with BS EN 10326 to provide a minimum zinc coating of 275 g/m².

(b) compatibility

Where two metals are to be joined they should be compatible and not cause bimetallic corrosion in that environment. Alternatively they should be isolated from each other.

The choice of fixings should take account of bimetallic corrosion which can occur when two dissimilar metals are in contact.

(c) connections

Light steel components should be securely fixed together by bolting, welding, riveting, clinching, crimping, screwing or nailing.

Connections using these techniques should be justified either by design to BS EN 1993-1-3 or an appropriate test acceptable to NHBC.

LOADBEARING WALLS

6.10 - D4 Loadbearing walls incorporating light steel members shall be designed to support and transfer loads to foundations safely and without undue movement

Items to take into account include:

(a) design

The structural design of loadbearing steel framed walls should be in accordance with BS EN 1993-1-3.

(b) design loadings

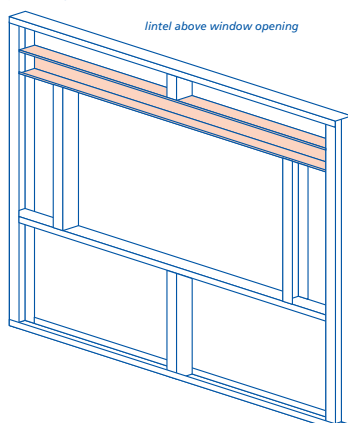
The building should be designed to resist loadings in accordance with BS EN 1991-1-1, BS EN 1991-1-3 and BS EN 1991-1-4 including:

- dead loads
- imposed loads
- wind loads.
- snow loads

(c) structural elements

Individual studs should not be less than 36mm wide, spaced at not more than 600mm centres, unless agreed with NHBC and other support is provided for wall boards and fixings.

A lintel should be provided to any opening in loadbearing panels where one or more studs is cut or displaced to form the opening. A lintel is not required where an opening falls between studs.



Additional studs may be required at openings for fixing ties or supports for the cladding.

Multiple studs should be included to support multiple joists unless otherwise specified by the designer.

Lintels should be securely fixed to supporting studs to ensure that loads are transferred properly.

Where panels are diagonally braced with flat strip it should be fixed to each stud at the intersection to minimise the bow in the bracing member.

(d) joints between panels and other elements

The design should detail how wall panels are to be securely fixed:

- to the substructure
- to adjacent panels
- to the floor and roof framing.

Account should be taken of uplift forces and, where necessary, proper holding down devices should be provided to resist uplift. The anchorage for holding down devices should have sufficient mass to resist the uplift forces.

Timber wall plates should be fixed to the head rail of wall panels onto which timber roof trusses bear. The timber wall plate and head rail should be sized to permit single timber trusses to be positioned at any point between studs.

(e) racking

Wall panels may provide resistance to racking forces using one or more of the following techniques:

- internal bracing
- crossed flat bracing
- internal sheathing board
- external lining board
- rigid frame action.

Methods adopted should be justified either by design to BS EN 1993-1-1 or tested to BS EN 594.

NON-LOADBEARING WALLS

6.10 - D5 Non-loadbearing walls incorporating light steel members shall have adequate strength and support

Items to take into account include:

(a) construction

The following form of construction is acceptable:

- light steel partitions using studs, head and base rails from sections not smaller than 43mm x 32mm x 0.45mm
- stud spacings to suit the thickness of plasterboard, as follows:
 - not more than 450mm spacing for 9.5mm boards
 - not more than 600mm spacing for 12.5mm or thicker boards.

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(b) movement joints

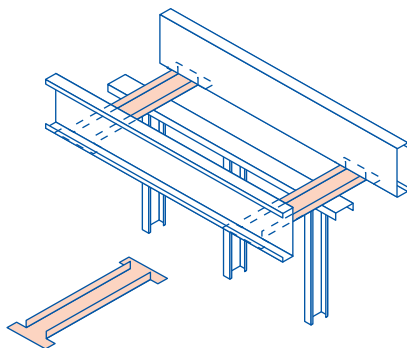
Non-loadbearing walls should not bridge movement joints in the main structure.

A joint should be constructed between the frame and any chimney or flue to prevent load transfer onto the chimney or flue.

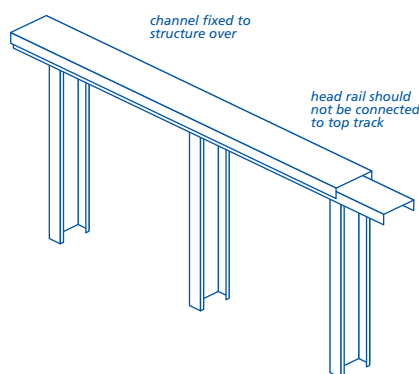
(c) support

Non-loadbearing walls should be supported from the structural floor, not by a floating floor that incorporates a compressible layer, unless the floating floor is specifically designed for that purpose.

Allowance should be made for the possible deflection of floors at the head of non-loadbearing walls to prevent the wall becoming loadbearing.



SUPPORT WHERE WALL IS PARALLEL AND BETWEEN JOISTS



SUPPORT WHERE FLOOR OR BEAM IS ABOVE WALL

MOISTURE CONTROL AND INSULATION

6.10 - D6 Wall designs shall ensure that the structure is adequately protected from the effects of moisture

Items to be taken into account include:

(a) provision of dpcs and dpms

Dpcs should be installed beneath and for the full width of the lowest section of framing (e.g. all ground floor walls and internal partitions) to protect the steel from corrosion due to moisture. The dpc should be wide enough to lap with the dpm.

Dpcs and trays should be provided at openings to prevent rain penetration.

(b) membranes

Breather membranes and other barriers, where provided, should be lapped so that each joint is protected and moisture drains outwards.

(c) cavities in external walls

A clear cavity should be provided to reduce the risk of rain penetrating to the frame. The following minimum cavity widths, measured between the claddings and sheathings, should be provided:

Cladding	Cavity width
Masonry	50mm nominal
Render on backed lathing	25mm nominal
Vertical tile hanging without underlay	No vertical cavity required when a breather membrane is provided
Other cladding*	15mm nominal

* see Chapter 6.9 'Curtain walling and cladding'

The cavity should extend at least 150mm below the dpc and be kept clear to allow drainage. Weep holes or other suitable means of drainage should be provided where necessary to prevent water build up in the cavity.

(d) insulation and interstitial condensation

The BRE Report 'Thermal insulation: avoiding risks' discusses aspects of insulation relevant to external light steel framed walls. In England and Wales account should be taken of Accredited Details for Part L.

A vapour control layer should be provided unless a condensation risk analysis in accordance with BS 5250 shows that one is not necessary. The vapour control layer should be fixed on the warm side of the wall insulation.

The vapour control layer should cover the external wall including base rails, head rails, studs, lintels and window reveals.

Vapour control layers should be of 500g polyethylene or vapour control plasterboard.

Insulation should continue 150mm below the base rail of the steel wall to minimise thermal bridging.

Insulation with an integral facing on one side only, e.g. a foil facing, should have the facing on the cavity side. The facing should not be used as the vapour control layer.

Service pipes, conduits, etc within walls should be on the warm side of the insulation.

EXTERIOR CLADDING

6.10 - D7 Exterior cladding shall be compatible with the steel frame

Items to be taken into account include:

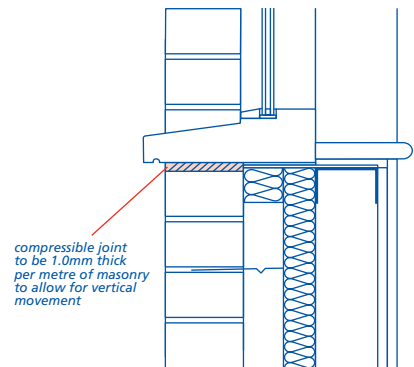
(a) wall ties

Wall ties for masonry claddings should be:

- of a type which accommodates differential movement between the light steel frame and the cladding - see clause D7(c) below
- fixed through to the studs, not the sheathing
- installed at a minimum density of 3.7 ties/m² e.g. spaced at a maximum of 600mm horizontally and 450mm vertically (see Sitework clause 6.10 - S5)
- spaced at jambs of openings a maximum of 300mm vertically within 225mm of the masonry reveal. Additional studs may be needed to achieve this
- inclined away from the light steel framing.

(b) masonry claddings

Soft joints should be provided to allow for differential movement. A gap of 1mm per metre of masonry should be provided at openings and soffits.



(c) other claddings

For other claddings reference should be made to Chapter 6.9 'Curtain walling and cladding' (Design and Sitework).

FLOORS

6.10 - D8 Suspended floors shall be designed to support and transmit loads safely to the supporting structure without undue deflection

Items to be taken into account include:

(a) dead and imposed loads

Floors should be designed to resist loading in accordance with BS EN 1991-1-1 including:

- dead loads
- imposed loads.

Information concerning balcony loading is given in Chapter 7.1 'Flat roofs and balconies' (Design and Sitework).

(b) joist spacing

Steel joists should be spaced at centres not greater than 600mm.

(c) deflection

The in-service performance of light steel joists should be controlled by four serviceability criteria:

Static criteria:

- i) the maximum deflection for a single joist due to imposed load should be limited to span/450
- ii) the maximum deflection for a single joist due to dead and imposed loads should be limited to the lesser of span/350 or 15mm.

Dynamic criteria:

- iii) the natural frequency of the floor should be limited to 8Hz for dead load plus 0.2 x imposed load. This can be achieved by limiting the deflection of a single joist to 5mm for the given loading
- iv) the deflection of the floor (i.e. a series of joists plus the floor decking) when subject to a 1kN point load should be limited to the following values:

Span (m)	Max. deflection (mm)
3.5	1.7
3.8	1.6
4.2	1.5
4.6	1.4
5.3	1.3
6.2	1.2

The deflection of a single joist is dependent on the overall floor construction and the number of effective joists that are deemed to share the applied 1kN point load. The following table gives typical values:

Floor configuration	Number of effective joists	
	Joist centres	
	400mm	600mm
Chipboard, plywood or oriented strand board	2.5	2.35
Built-up acoustic floor	4	3.5

(d) attachment to supporting structure

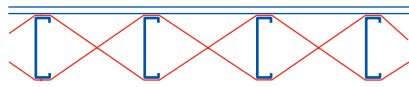
Light steel joists should be fixed to supporting walls by web cleats, direct attachment to wall studs, or by bearing onto the supporting structure. In the latter configuration, bearing stiffeners may be required.

(e) prevention of roll

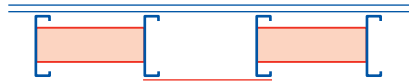
Floors constructed using joists with an asymmetric web (e.g. of 'C' or Sigma profile) can cause the floor to 'roll'. To avoid this, one of the following alternatives should be used where the span exceeds 3.5m for 'C' joists or 4.2m for Sigma joists:

- a continuous line (or lines) of proprietary steel herringbone struts provided between the joists. The pairs of struts should have a physical gap between them so that they do not rub against

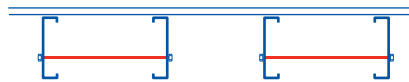
each other at the cross-over point and create noise



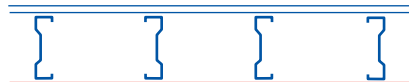
- solid blocking provided to every third pair of joists with ties between them



- joists alternately reversed and tied together in pairs



- joists alternately reversed and continuous ties (e.g. resilient bar) fixed to the joist flanges.



(f) floor decking

The correct thickness of decking should be specified for the joist centres used.

The thickness should be not less than those shown in this table for normal domestic loads, i.e. an imposed load of 1.5kN/m².

Floor decking	Thickness of decking [mm]	
	Joist centres	
	400mm	600mm
Chipboard	18	22
Plywood	15	18/19
Oriented strand board	15	18/19

Note

Oriented strand board should be laid with the stronger axis at right angles to the supports. Other decking materials not listed in the table should comply with Technical Requirement R3. The above thicknesses may not be adequate to achieve a mass for floor decking of 15 kg/m² for sound insulation requirements of floors in England & Wales.

The floor deck is generally used as a diaphragm and, to achieve this, floor boarding should be attached using self-drilling, self-tapping screws, ring shank nails or other approved fixings at 300mm maximum centres. T&g joints should be glued.

(g) openings

Suitably sized trimmers should be provided around floor openings.

(h) notching and holing

The flanges of light steel joists should not be notched except to accommodate connections.

Drilling or punching through the web should only be carried out within recognised limits (see Sitework clause 6.10-S11).

(i) ground floors

Light steel joists used in ground floor construction should have thermal insulation positioned to ensure that condensation does not form on the joists.

The junction between the ground floor joists and their support should be designed to maintain the durability of the floor. Light steel floor joists and ring beams in ground floors should be galvanised to 450g/m². Alternatively they can be galvanised to 275g/m² with additional protection of a two-coat bitumen based coating to BS 1070, BS 3416 or BS 6949, or have a two coat liquid asphaltic composition applied. Ring beams to ground floors should be totally protected and joists protected for 300mm adjacent to an external wall support or ring beam.

(j) resistance to ground moisture

Provision should be made to prevent ground moisture affecting light steel floors.

This can be achieved by either:

- 50mm concrete or 50mm fine aggregate on a polyethylene membrane laid on 50mm sand blinding, or
- 100mm concrete.

Where necessary, oversite concrete should be protected against sulfate attack by the use of a polyethylene sheet dpm, not less than 1200 gauge (0.3mm) (or 1000 gauge if assessed in accordance with Technical Requirement R3), properly lapped.

(k) ventilation of underfloor voids

A minimum ventilation void of 150mm should be provided below the floor.

On shrinkable soils where heave could take place, an allowance for movement should be added to the underfloor ventilation requirement to determine the minimum dimension of the floor void. The allowance for movement relates to the shrinkage potential of the soil as follows:

- high potential - 150mm
- medium potential - 100mm
- low potential - 50mm.

Voids should be ventilated by openings providing not less than either 1500mm² per metre run of external wall or 500mm² per m² of floor area, whichever gives the greater opening area.

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Every part of the void under the floor should be thoroughly ventilated through openings on at least two opposite sides.

SERVICES

6.10 - D9 Services shall be adequately protected from damage

Cutting of service holes on site should be avoided since badly cut edges can have an adverse affect on the durability of the frame and may cause damage to pipes and cables.

Grommets should be used around the edge of service holes to protect electrical cables and reduce the risk of bimetallic corrosion. Swagged holes for electric cables and plastic piping do not require grommets.

Service mains and service outlets should be designed to ensure the fire resistance of walls and floors is not impaired.

In Scotland, services are not permitted within framed separating walls.

ACOUSTIC PERFORMANCE

6.10 - D10 Internal walls and floors shall be designed to adequately resist the passage of sound

Designs should be in accordance with relevant Building Regulations and other statutory requirements.

CONTROL OF FIRE

6.10 - D11 Walls and floors shall resist the spread of fire

All structural elements should have adequate fire resistance.

Items to be taken into account include:

(a) ceilings

Ceilings should provide the necessary fire protection to floors constructed with light steel joists. Either one or two layers of plasterboard are required and at least one of these should be fire-rated. When two layers of board are used, joints should be staggered between layers. Boards should be attached using self-drilling, self-tapping screws.

(b) cavity barriers

Cavity barriers should be provided in accordance with relevant Building Regulations.

Horizontal cavity barriers (except under eaves) should be protected with a dpc tray. The tray should have a minimum upstand of 100mm. Alternatively polyethylene encased cavity barriers providing a minimum upstand of 100mm should be used.

(c) fire-stops

Fire-stops should be provided in accordance with relevant Building Regulations.

PROVISION OF INFORMATION

6.10 - D12 Designs and specifications shall be produced in a clearly understandable format and include all relevant information

For light steel framed walls and floors, the following information should be available:

- relevant drawings
- materials specification
- fixing schedules
- fixing details
- manufacturers' recommendations relating to proprietary items.

The information should be in a form suitable for the use of site operatives and be available on site before and during construction.

Assembly instructions should allow for every structural connection made on site including fixing details for framing, wall ties and should show as appropriate:

- number and spacing of bolts, screws and rivets
- size and type of each fixing type, including corrosion protection.

6.10 - D13 All relevant information shall be distributed to appropriate personnel

Ensure that design and specification information is issued to site supervisors and relevant specialist subcontractors and/or suppliers.

Where proprietary products are to be used, manufacturers usually have specific requirements for fixing and/or assembly of their products. This information should also be made available for reference on site so that work can be carried out satisfactorily in accordance with the design and specification.

Copies of the assembly instructions should be given to the person doing the job.

CERTIFICATION

6.10 - D14 Design of the superstructure shall be checked by an NHBC steel frame certifier

The specific project details should be checked by an NHBC steel frame certifier so that a certificate can be issued in accordance with Appendix 6.10-A. The project certificate should be made available on site for inspection by NHBC.

MATERIALS STANDARDS

6.10 - M1 All materials shall:

- (a) meet the Technical Requirements
- (b) take account of the design

Materials that comply with the design and the guidance below will be acceptable for external and internal walls, and floors using light steel framing.

Materials for external and internal walls and floors using light steel framing should comply with all relevant standards, including those listed below. Where no standard exists, Technical Requirement R3 applies (see Chapter 1.1 'Introduction to the Standards and Technical Requirements').

References to British Standards and Codes of Practice include those made under the Construction Products Directive (89/106/EEC) and, in particular, appropriate European Technical Specifications approved by a European Committee for Standardisation (CEN).

STEEL AND FIXINGS

6.10 - M2 Steel and fixings shall be suitable for the design and adequately protected against corrosion

Items to be taken into account include:

(a) steel

Steel should be grade S280 or S350 to BS EN 10326. Grade S390 steel may be used if it has a nominal yield strength of 390N/mm² and meets the concepts of BS EN 10326.

To provide adequate protection against corrosion due to condensation and the environment, the steel should be pre-galvanised in accordance with BS EN 10326 to provide a minimum zinc coating of 275g/m².

Light steel floor joists and ring beams in ground floors should be galvanised to 450g/m². Alternatively they can be galvanised to 275g/m² with additional protection of a two-coat bitumen based coating to BS 1070, BS 3416 or BS 6949, or have a two coat liquid asphaltic composition applied. Ring beams to ground floors should be totally protected and joists protected for 300mm adjacent to the support or ring beam.

(b) compatibility

Where two metals are to be joined they should be compatible and not cause bimetallic corrosion in that environment. Alternatively the two metals should be isolated from each other.

The choice of fixings needs to take account of bimetallic corrosion which can occur when two dissimilar metals are in contact.

(c) connectors

The following connectors are acceptable:

- zinc plated bolts should be in accordance with BS 4190
- countersunk bolts should be in accordance with BS 4933
- screws should be in accordance with BS 5427
- rivets should be in accordance with the manufacturer's recommendations
- self-piercing rivets should be in accordance with the manufacturer's recommendations
- ring shank nails should be in accordance with BS EN 10263
- welded connections should be in accordance with BS 5135. The welding wire should be in accordance with BS 2901.

Cleats should comply with the requirements of BS EN 1993-1-1.

(d) holding down devices

Holding down devices should be manufactured from mild steel with zinc coating to BS 729 or BS 1706 and be suitable for the environment they will be exposed to.

Holding down devices manufactured from stainless steel to BS EN 10095 will be suitable in any environment.

DAMP-PROOF COURSES

6.10 - M3 Materials for damp-proofing shall adequately resist the passage of moisture

Materials which are acceptable for use as dpcs include:

- polyethylene to BS 6515
- bitumen to BS 6398
- proprietary materials assessed in accordance with Technical Requirement R3.

WALL TIES AND FIXINGS

6.10 - M4 Wall ties and fixings shall connect the steel frame to the cladding in accordance with the design

For masonry claddings wall ties should be of austenitic stainless steel, phosphor bronze or silicon bronze. Materials for wall ties should be compatible. Stainless steel, phosphor bronze and silicon bronze are compatible with each other.

For other claddings, ties and fixings should be assessed in accordance with Technical Requirement R3.

SHEATHING

6.10 - M5 Sheathing shall be durable and capable of providing structural resistance to racking

Cement bonded particle board sheathing should be in accordance with BS EN 634 and BS EN 13986.

Plywood sheathing should be:

- of performance characteristics determined in accordance with BS EN 13986 table 7
- suitable for in humid conditions to BS EN 636
- at least 5.5mm thick
- appropriate to the exposure of the building.

Oriented strand board should be OSB3 to BS EN 300 and be at least 8mm thick.

Proprietary sheathing materials should be assessed in accordance with Technical Requirement R3 and used in accordance with the assessment.

BREATHER MEMBRANES

6.10 - M6 Breather membranes shall be capable of allowing water vapour from within the frame to pass out into the cavity and protect the sheathing and frame from external moisture

Breather membranes should be:

- vapour resistant to less than 0.6MNs/g when calculated from the results of tests carried out in accordance with BS 3177 at 25°C and relative humidity of 75%
- capable of resisting water penetration
- self-extinguishing
- durable
- adequately strong when wet to resist site damage
- Type 1 to BS 4016 in areas of Very Severe exposure.

THERMAL INSULATION

6.10 - M7 Insulation materials shall be of a suitable thickness to comply with the design and statutory requirements

Insulation materials should be inert, durable, rot and vermin proof and should not be adversely affected by moisture or vapour.

The following materials are acceptable:

- mineral wool to BS EN 13162
- FR (flame retardant) grade expanded polystyrene to BS EN 13163
- FR (flame retardant) grade extruded polystyrene to BS EN 13164
- rigid polyurethane foam and polyisocyanurate to BS EN 13165
- phenolic foam to BS EN 13166
- cellular glass to BS EN 13167.

Other insulation materials should be assessed in accordance with Technical Requirement R3.

VAPOUR CONTROL LAYERS

6.10 - M8 Vapour control layers shall restrict the passage of water vapour from within the dwelling to the steel frame

Minimum 500 gauge polyethylene sheet or vapour control plasterboard should be used.

Vapour control products manufactured from recycled materials should be assessed in accordance with Technical Requirement R3.

PLASTERBOARD

6.10 - M9 Plasterboard shall be of a suitable thickness for its intended use

Plasterboard should be to BS 1230. Plasterboard thickness should be not less than:

- 9.5mm for stud spacings up to 450mm
- 12.5mm for stud spacing up to 600mm.

To provide fire-resistance, fire-rated boards should be used and installed in accordance with the manufacturer's instructions.

CAVITY BARRIERS AND FIRE-STOPS

6.10 - M10 Materials used for cavity barriers and fire-stops shall be capable of providing adequate resistance to fire and smoke

Materials specified in statutory requirements are acceptable.

Suitable fire-stopping materials include:

- mineral wool
- glass wool
- cement mortar
- gypsum plaster
- intumescent mastic or preformed strip
- proprietary sealing systems (particularly those designed for service penetrations) assessed in accordance with Technical Requirement R3 to maintain the fire resistance of the wall.

FLOOR DECKING

6.10 - M11 The type and thickness of the decking material shall have adequate strength and moisture resistance

The following materials are acceptable:

- moisture-resistant chipboard Type P5 to BS EN 312
- oriented strand board Type OSB3 to BS EN 300
- plywood in accordance with BS EN 636.

Fixings and supports should be as recommended by the manufacturer.

Floor decking materials not covered by a British Standard should be assessed in accordance with Technical Requirement R3.

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SITWORK STANDARDS

6.10 - S1 All sitework shall:

- (a) meet the Technical Requirements
- (b) take account of the design
- (c) follow established good practice and workmanship

Sitework that complies with the design and the guidance below will be acceptable for external and internal walls, and floors using light steel framing.

Information in a form suitable for the use of site operatives should be available on site before and during construction including:

- relevant drawings
- materials specification
- fixing schedules
- fixing details
- manufacturers' recommendations relating to proprietary items.

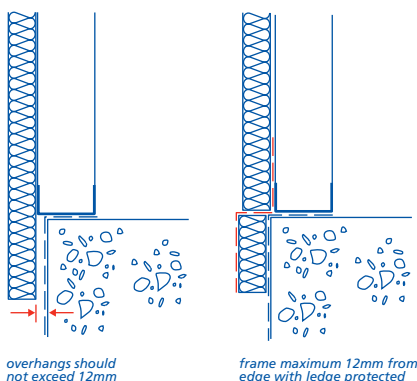
CONSTRUCTION OF LOADBEARING WALLS AND EXTERNAL INFILL WALLS

6.10 - S2 Construction of loadbearing walls and external infill walls shall ensure adequate stability

Items to be taken into account include:

(a) setting out

The structure onto which the light steel frame is to be erected should be correctly set out in accordance with the design. The loads from the light steel frame should be supported as detailed in the design.



The supporting structure may have local deviations in level along its length and some packing will be required to achieve the required tolerances and to provide for effective load transfer.

The following guidance should be used, unless the frame manufacturer confirms otherwise:

Gap under base rail	Acceptable packing
less than 10mm	provide shims under each stud position
10 - 20mm	provide shims under each stud position and grout under the whole length of the base rail with cement:sand mortar
more than 20mm	obtain advice from the frame designer/manufacturer - remedial work to the substructure may be required before erection commences

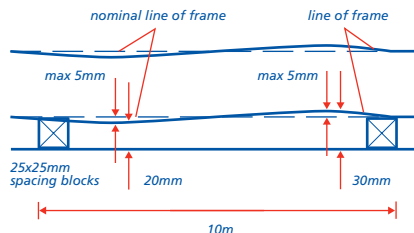
Shims should be of pre-galvanised steel. Plastic or timber shims are not acceptable.

(b) accuracy of walls

Wall frames should be checked to ensure that they are dimensionally accurate before erection commences.

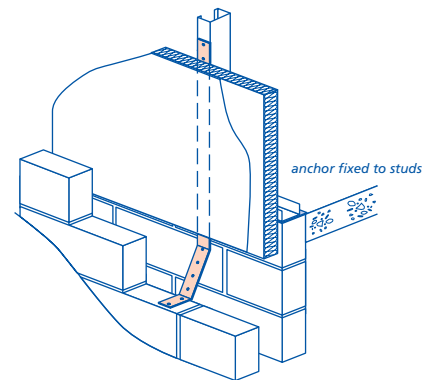
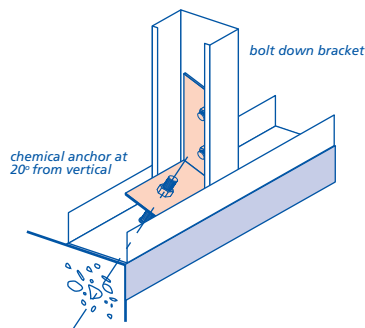
All light steel framing should be correctly positioned, square and plumb. The verticality of a light steel frame, relative to its base should be +/- 5mm per storey.

The horizontal position of the base rail should not vary in alignment by more than 5mm in 10m.



(c) anchoring the frame

The frame should be anchored to resist both lateral movement and uplift as required by the design.



Shot-fired fixings should observe a minimum edge dimension to prevent spalling at edges of masonry or slabs. When shotfiring into masonry, solid concrete blocks with a minimum crushing strength of 7.3 N/mm² should be used, positioned to receive fixings.

Where the design incorporates gas membranes (methane or radon) fixings should not puncture them but where this is unavoidable the penetration should be sealed.

(d) alterations

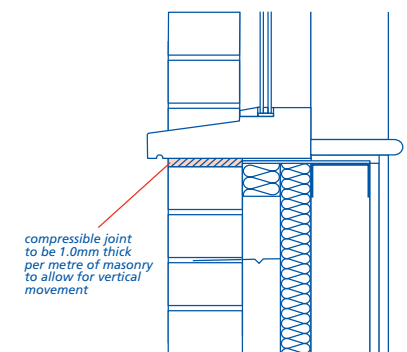
Steelwork should only be altered with the approval of the designer. Welded or flame cut edges should be cleaned before being treated with a zinc-rich paint to prevent corrosion.

(e) fixing panels

Wall panels should be securely fixed together and to floors in accordance with the design.

(f) masonry claddings

Soft joints should be provided to allow for differential movement. A gap of 1mm per metre of wall height should be provided at openings and soffits.



(g) supporting claddings

Masonry claddings should not be supported by the light steel framed walls unless shown in the design.

Masonry claddings may be tied to the light steel framed walls with flexible wall ties fixed through to the studs.

Lightweight claddings should be supported by the light steel framed walls on battens or by other suitable means unless shown otherwise in the design.

(h) fixing wallboard

Plasterboard should be fixed in accordance with Chapter 8.2 'Wall and ceiling finishes' (Sitework).

Other wallboards should be fixed in accordance with the manufacturer's recommendations.

Wallboards should be attached to light steel studs using self-drilling, self-tapping screws at not more than 300mm centres.

Other fixings should be in accordance with the manufacturer's recommendations.

Particular care should be taken at the junction between walls and roofs. Reference should be made to Chapter 8.2 'Wall and ceiling finishes' (Sitework).

(i) movement between steel frame wall and other elements

Movement joints between light steel framed walls and other elements should be provided in accordance with the design.

A joint should be constructed between the frame and any chimney or flue to prevent load transfer onto the chimney or flue.

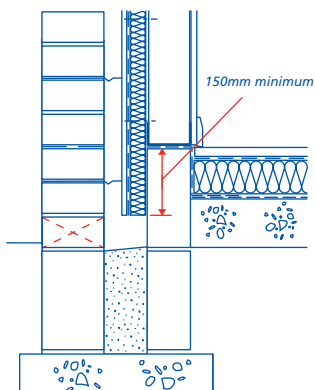
(j) cavities

A clear cavity should be provided to reduce the risk of rain penetrating to the frame. The following minimum cavity widths, measured between the claddings and sheathings, should be provided.

Cladding	Cavity width
Masonry	50mm nominal
Render on backed lathing	25mm nominal
Vertical tile hanging without underlay	No vertical cavity required when a breather membrane is provided
Other cladding*	15mm nominal

* see Chapter 6.9 'Curtain walling and cladding'

The cavity should be extended at least 150mm below the dpc and be kept clear to allow drainage. Weep holes or other suitable means of drainage should be provided where necessary to prevent water build up in the cavity.



INSULATION

6.10 - S3 Insulation shall be correctly installed

Insulation should cover the whole external face of the wall and extend 150mm below the bottom rail to maintain a warm frame.

Insulation boards should be tightly butted. Joints between boards should be taped with a suitable tape where required by the design.

Foil-faced insulation boards with an integral facing on one side only should be fixed with the foil face on the cavity side.

BREATHER MEMBRANES

6.10 - S4 Breather membranes shall be provided where required by the design

Breather membranes should be lapped so that each joint is protected and moisture drains outwards.

Laps should be at least 100mm on horizontal joints and 150mm on vertical joints.

WALL TIES AND FIXINGS

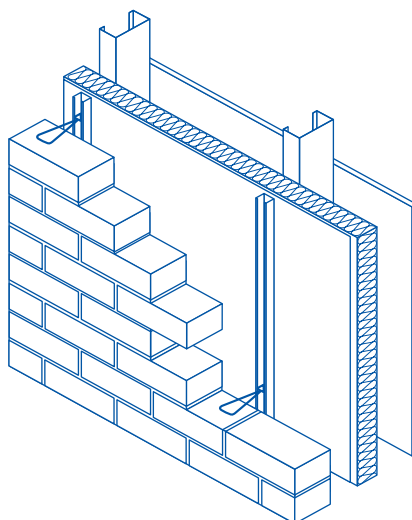
6.10 - S5 Wall ties and fixings shall be correctly installed

Wall ties should:

- be fixed through to the studs
- be inclined away from the light steel framing
- be kept clean and free from mortar droppings.

Wall ties should be spaced as required by the design but not less than 3.7 ties/m² e.g. spaced at a maximum of 600mm horizontally and 450mm vertically. At jambs of openings the spacing should be a maximum of 300mm vertically with ties set within 225mm of the masonry reveal.

Other fixings should be of the type specified, and be fixed in accordance with the design.



VAPOUR CONTROL LAYERS

6.10 - S6 A vapour control layer shall be correctly installed in accordance with the design

Where required by the design a vapour control layer should be fixed on the warm side of the insulation and frame.

The vapour control layer should be of the material specified in the design. Minimum 500 gauge polyethylene sheet or vapour control plasterboard should be used.

Where polyethylene sheet is used all joints in the vapour control layer should have at least 100mm laps, located on studs or noggings. Double sided tape or adhesive should be used as a temporary fixing before the wall board is fixed.

Where vapour control plasterboard is used, joints between sheets should be positioned on studs or noggings. When cutting vapour control plasterboard, care should be taken not to displace the vapour control material.

Any holes made in the vapour control layer should be made good and sealed.

The vapour control layer should cover the external wall including base rails, head rails, studs, lintels and window reveals.

At the base of the wall the vapour control layer should overlap the base rail.

CLADDING

6.10 - S7 Cladding shall be correctly installed

Masonry cladding should be constructed in accordance with Chapter 6.1 'External masonry walls' (Design and Sitework).

For other claddings reference should be made to Chapter 6.9 'Curtain walling and cladding' (Design and Sitework).

A clear cavity should be provided between the sheathing and the cladding. The cavity should be drained. Where wall areas are divided by cavity barriers, the drainage of the cavity should be maintained or cavity trays and weep holes installed.

Drainage at the base of the cladding system should be equivalent to 500mm²/m run (e.g. for masonry, one open perpendicular every 1.5m).

Openings for drainage should be placed to prevent the ingress of rain.

The cavity should be kept clean, free of obstructions and should be capable of draining freely.

6.10 Light steel framed walls and floors

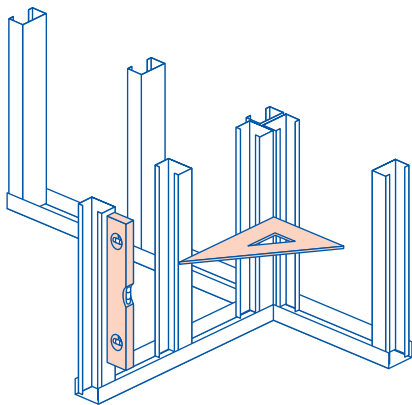
CONSTRUCTION OF NON-LOADBEARING INTERNAL WALLS

6.10 - S8 Construction of non-loadbearing internal walls shall ensure adequate stability

Items to be taken into account include:

(a) setting out and workmanship

Partitioning should be correctly positioned, square and plumb.



Studs should be spaced at maximum 450mm or 600mm centres to suit the wall board thickness as required by the design. Extra studs should be provided at openings, if required by the design.

(b) size of steel members

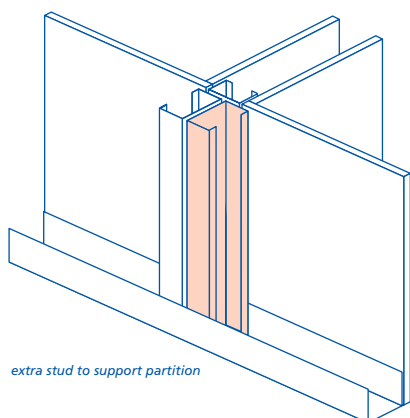
Non-loadbearing partitions should be constructed in accordance with the design.

(c) alterations

Steelwork should only be altered with the approval of the designer. Welded or flame cut edges should be cleaned and treated with a zinc-rich paint to prevent corrosion.

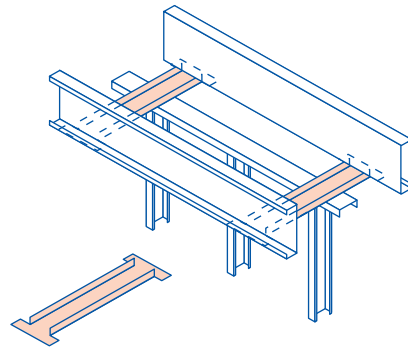
(d) support and fixings

Non-loadbearing partitions should be fixed in accordance with the design. They should be fixed to the floor on which they stand, at the head, to each other and to abutting walls. Noggings or extra studs should be used where shown in the design.

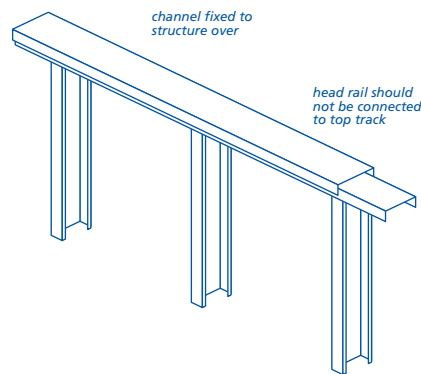


extra stud to support partition

Non-loadbearing partitions should not be wedged against floor joists, ceiling joists or roof trusses. Allowance should be made for the floor joists, ceiling joists or roof trusses to deflect so that the partition does not become loadbearing.



SUPPORT WHERE WALL IS PARALLEL AND BETWEEN JOISTS



channel fixed to structure over

head rail should not be connected to top track

SUPPORT WHERE FLOOR OR BEAM IS ABOVE WALL

Noggings or straps should be provided as required to support fittings, such as radiators, wall-mounted boilers, sanitary fittings, kitchen units, etc.

Fixing and finishing of partitions should be in accordance with Chapter 8.2 'Wall and ceiling finishes' (Sitework).

SEPARATING WALLS

6.10 - S9 Construction of separating walls shall ensure adequate sound insulation

The design details should be carefully followed.

There should be no gaps in the:

- mineral wool quilt or batts
- wallboard layers
- fire-stopping.

Services in or adjacent to separating walls should be installed in accordance with the design. (See clause 6.10 - S17).

LIGHT STEEL JOISTS

6.10 - S10 Light steel joists shall be selected, located and supported as detailed in the design

Items to be taken into account include:

(a) protection

Where required by the design ground floor joists should be protected by the application of a two-coat bitumen based coating, or have a two-coat liquid asphaltic composition applied. Ring beams to ground floors should be totally protected and joists protected for 300mm adjacent to the support or ring beam.

(b) joist spacings

Joist spacings should be as shown in the design.

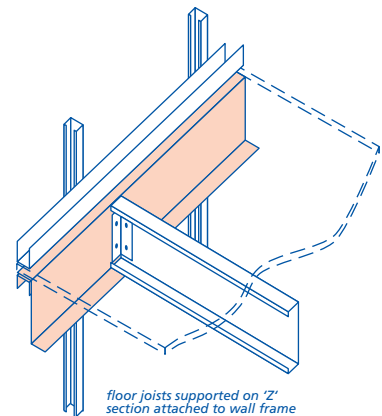
(c) joist support cleats

Joist support cleats should be of the correct type and fitted in the specified location with the fixings specified in the design.

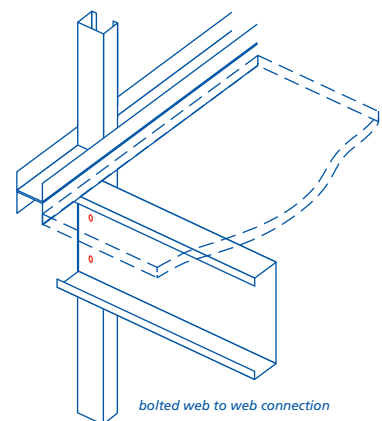
Where joists are fitted directly to light steel wall studs, pre-drilled holes should be correctly aligned before making the final connection.

Fixing holes should not be enlarged and additional holes should not be cut without the consent of the designer.

Where required, web stiffeners should be properly fitted to ensure good bearing.

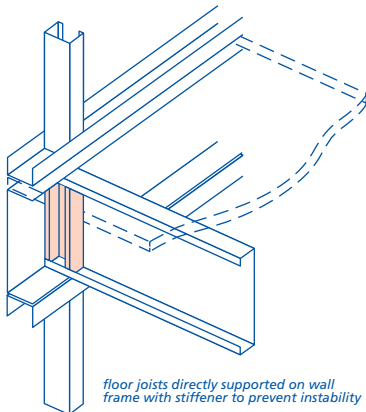


floor joists supported on 'Z' section attached to wall frame



bolted web to web connection

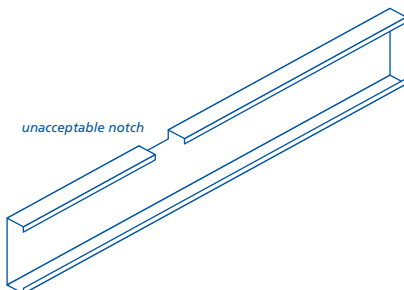
(d) joist length and end support



Joists should be accurately cut to length in the factory to ensure a tight fit. The correct type, size and number of fixings should be as specified at every connection.

(e) support of trimmed and trimming joists

Some end notching of light steel joists may be required for interconnection of trimming joists. This should be in accordance with the design. Notches elsewhere in the span are unacceptable. Welded or flame cut edges should be cleaned and treated with zinc-rich paint to prevent corrosion.



(f) joist bearings

Where light steel joists are supported by steel joists, cleats or web stiffeners should be used in accordance with the design.

(g) fixing of multiple joists

Joists may be doubled up to support partitions or to form trimmers. Fixings should be in accordance with the design and should be properly installed. Bolted connections should be tightened to the torque given in the design.

(h) prevention of roll

Bridging and blocking should be provided in accordance with the design to prevent roll.

Floors constructed with joists with an asymmetric web (e.g. of 'C' or Sigma profile) can cause the floor to 'roll'.

To avoid this one of the following alternatives should be provided where the

span exceeds 3.5m for 'C' joists or 4.2m for Sigma joists unless otherwise specified in the design:

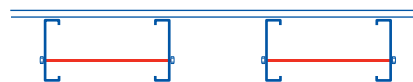
- a continuous line (or lines) of proprietary steel herringbone strutting provided between the joists. The pairs of ties should have a physical gap between them so that they do not rub against each other at the cross-over point and cause noise



- solid blocking provided to every third pair of joists with ties between



- joists alternately reversed and tied together in pairs



- joists alternately reversed and continuous ties (e.g. resilient bar) fixed to the joist flanges.



Where joists bear onto steelwork or are supported by cleats, blocking is not necessary adjacent to the supports.

(i) alterations

Joists should only be altered with the approval of the designer. Welded or flame cut edges should be cleaned and treated with a zinc-rich paint to prevent corrosion.

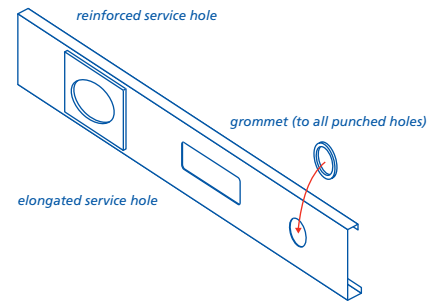
6.10 - S11 Joists shall be drilled or holes punched within recognised limits

The flanges of a light steel joist should not be notched unless in accordance with the design.

Drilling or punching through the web should only be carried out within recognised limits.

Unstiffened holes through the web should be carried out within the following limits:

- a rectangular hole or slot should not exceed 40% of the overall depth of the member. The length of the hole should not exceed three times the depth of the hole
- the diameter of circular holes should not exceed 60% of the depth of the member
- unstiffened holes should be at least the depth of the member apart and at least 1.5 times the depth from the end of the member.



6.10 - S12 Restraint strapping shall be provided in accordance with the design

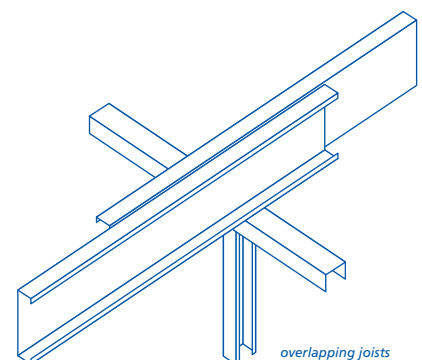
Where external walls, not constructed from light steel framing, are to be stabilised by a connection to the floor, straps may be required. Straps will generally be fixed to the web of the joist, to suit the masonry courses.

Where joists run parallel to the wall, straps should be supported on noggings fixed between the joists. Straps should be placed at a maximum of 2m apart and carried over three joists. Packing should be provided between the wall and the first joist.

Straps should be fixed with suitable bolts, screws or rivets and should bear on the centre of bricks or blocks, not across mortar joints.

6.10 - S13 Overlapping joists shall be properly fixed to prevent disruption of finishes

Where joists overlap on loadbearing intermediate walls they should be fixed together with bolts or screws to prevent the floor decking being pushed up or the ceiling being cracked when the cantilevered part of the joist moves upwards.



6.10 - S14 Continuous joists shall be reinforced in accordance with the design

Where joists are continuous over loadbearing intermediate walls, they should be reinforced as required by the design.

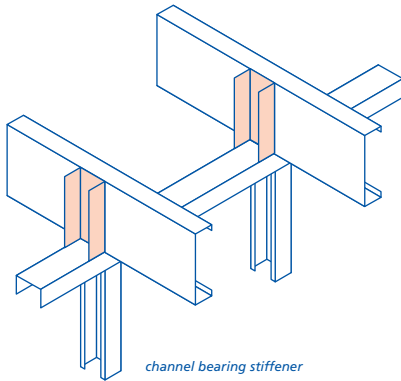
6.10 Light steel framed walls and floors

6.10 - S15 Floor decking and ceilings shall be adequately fixed

Items to be taken into account include:

(a) decking

Flooring should be attached using self-drilling, self-tapping screws, ring shank nails or other approved fixings in accordance with the design at centres not more than 300mm. T&g joints should be glued.



(b) ceilings

Plasterboard should be fixed in accordance with Chapter 8.2 'Wall and ceiling finishes' (Sitework) using self-drilling, self-tapping screws.

Other ceiling boards should be fixed in accordance with the manufacturer's recommendations.

SEPARATING FLOORS

6.10 - S16 Construction of separating floors shall ensure adequate sound insulation

The floating part of a floor should be completely separated from the main structure and surrounding walls by a resilient layer.

All joints should be glued where boards are laid loose over insulation without battens.

SERVICES

6.10 - S17 Services shall be adequately protected from damage

Services and service outlets should be installed in accordance with the design.

Light steel studs should not be notched to accommodate services. Holing of structural light steel members should only be carried out as detailed in the Clause 6.10 - S11 unless approved by the designer. Welded or flame cut edges should be cleaned and treated with zinc-rich paint to prevent corrosion.

Cutting of service holes on site should be avoided since badly cut edges can have an adverse affect on the durability of the frame and may cause damage to pipes and cables.

Grommets should be used around the edge of service holes to protect electrical cables and reduce the risk of bimetallic corrosion between the light steel framing and copper pipes.

Swaged holes will not require grommets for the passage of electric cables and plastic piping.

In Scotland services are not permitted within a separating wall cavity.

CONTROL OF FIRE

6.10 - S18 Fire spread shall be controlled as detailed in the design

Items to be taken into account include:

(a) walls

Walls should be constructed in accordance with the design and relevant Building Regulations to achieve the necessary fire resistance.

(b) floors

Floors should be constructed in accordance with the design and relevant Building Regulations to achieve the necessary fire resistance.

(c) cavity barriers and fire-stops

Cavity barriers and fire-stops should be installed in positions detailed by the design and relevant Building Regulations.

Service penetrations in floors between dwellings should be fire-stopped. There should be no holes or gaps for smoke to penetrate once the fire-stopping has been installed.

- A detailed description of the system
- Details of any limitations of its use
- Information for reference by the designer and steel frame project certifier.

* The manufacturer is the company which assembles the steel frame sections to form the wall and/or floor panels.

If in doubt consult with NHBC Technical.

Stage 2 - Project certification

NHBC requires the builder to appoint a steel frame project certifier to check the specific design of the steel framed housing on the specific site.

The steel frame project certifier will ensure that the proposals are in accordance with:

- The manufacturer's system certificate issued by SCI, and
- NHBC Standards Chapter 6.10 'Light steel framed walls and floors'.

In order to provide confirmation that both documents have been satisfied for a specific project, the steel frame project certifier will need to check supporting details and calculations.

If satisfied that the specific project details are satisfactory, the steel frame project certifier will issue a 'project certificate' to the builder.

Project certificates can only be issued by steel frame certifiers who have been approved by NHBC*.

The project certificate should be made available on site for inspection by NHBC.

* Applications to become a steel frame certifier should be made to NHBC Standards & Technical, Davy Avenue, Knowlhill, Milton Keynes MK5 8FP.

APPENDIX 6.10-A

Certification procedure

This Appendix outlines the two-stage certification process required by NHBC for light steel framed housing:

Stage 1 - System certification

NHBC requires manufacturers* of steel frame systems forming loadbearing wall and floor panels to submit details in the form of a system manual, to the Steel Construction Institute (SCI), Silwood Park, Ascot, Berkshire, SL5 7QN for assessment.

The system manual must contain all of the information shown in Table 1 (overleaf). Where there are choices (e.g. types of claddings) the manufacturer will need to specify which options the SCI is to consider in its assessment.

The SCI will, upon satisfactory completion of the assessment, issue a numbered 'system certificate' and approve the manufacturer's system manual. The system certificate issued by the SCI will include the following information:

Table 1 - Information to be contained in the system manual

This table outlines the minimum information that should be provided in the system manual. The SCI may ask for additional information.

Topic	Description
Description of system	Key features
Application	The use(s) to which the system can be put, e.g. max number of storeys, type of cladding
Durability	Confirmation that design life is at least 60 years Grade of steel Corrosion protection Supplementary protection
Strength and stability	Structural design philosophy including Codes of Practice referenced and test reports Grade of steel (traceability) Section properties Loading Ultimate Limit State Serviceability Limit State Resistance to overturning Racking resistance Holding down Connections Structural integrity Positions and sizes of holes through members
Claddings	Which claddings are acceptable? Provision of cavity Type of wall ties
Behaviour in relation to fire	Which internal linings are necessary? Fire-stops and cavity barriers
Condensation risk	Type, thickness and location of insulation material
Sound insulation	Does specification comply with Building Regulations/Robust Details?
Balconies, terraces, and parapets	Any specific design considerations
Other	Other information of relevance to the designer and steel frame certifier

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